

REMARKS

Favorable reconsideration and allowance of this application are requested.

I. Comments re Claim Amendments

At the outset, independent claim 1 has been revised so as to clarify the claimed invention and its patentable differences over the applied references of record. Corresponding revisions have been made to many of the dependent claims so each is in conformance to the language now employed in the amended version of claim 1.

With regard to the claim amendments, the Examiner will note that the substance of claim 2 has now been incorporated into the amended version of claim 1 so that the latter now requires the composition to be "substantially free from a phosphorous-containing flame retardant. The resin composition in amended claim 1 is also specified to be one which comprises a phenol-series antioxidant, a heat stabilizer, and a processing stabilizer which are recited in specific proportions to one another, respectively. Please see claim 10, and page 29, lines 10-14, page 36. line 17 to page 37, line 4, and page 44, lines 3-9 of the specification for support.

Furthermore, based on original claim 12, the heat stabilizer is specified in the amended version of claim 1 to be at least one member selected from the group consisting of a basic nitrogen-containing compound, a metal salt of an organic carboxylic acid, and an alkali or alkaline earth metal compound.

The processing stabilizer is specified to at least one member selected from the group consisting of a long-chain or higher fatty acid or a derivative thereof, a polyoxyalkylene glycol, and a silicone-series compound based on page 37, lines 15-18 of the specification.

The phenol component (B1) is specified to be at least one member selected from the group consisting of (i) a resin of which a main chain *or* a side chain has an aromatic ring having a hydroxyl group, and (2) a polyphenol selected from the group consisting of

a polyhydric phenol, a trisphenol, a catechin compound, a teanine, a tannin and a lignin. Such amendments are based on original claim 3, and on page 13, line 18, and page 20, line 25 to page 21, line 6 of the specification.¹

The amino acid (B2) is specified to at least one member selected from the group consisting of an α -amino acid, a β -amino acid, a γ -amino acid and a δ -amino acid, based on claim 6.

The phrase "a bisphenol" has been deleted from claim 4. In addition, the phrase "an antioxidant, a heat stabilizer, a processing stabilizer" has been deleted from claim 10.

Claims 2-3, 6, 12 and 14-18 have been cancelled as redundant thereby leaving claims 1, 4-5, 7-11, 13 and 19-21 pending herein. Therefore, reconsideration and allowance of such pending claims is solicited.

II. Response to Art-Based Rejections

The Examiner asserts that claims 1-21 are unpatentable under 35 USC §103(a) over Japanese Patent No. 2001-72830 ("the JP '830 patent") in view of Japanese Patent No. 63-260949 ("the JP '949 patent"). Moreover, the Examiner asserts that in view of the similarities of the resinous components of the applied JP '830 and '949 patents, and USP 6,753,363 to Harashina, it would have been obvious to employ the amino acid of Harashina as a specific type of nitrogen component such as those types suggested by the Japanese references.²

¹ In addition, the paragraph on page 8, line 22 through page 10, line 9 of the originally filed specification has been amended so as to conform lines 5-6 on page 9 thereof to page 13, lines 17-19 and thereby correct a typographical error therein.

² It is noted that, although the Examiner mentions Harashina in the body of the rejection, it is not listed in combination with either the JP '830 patent or the JP '949 patent. Thus, for purpose of this response, applicants will assume that the rejection should have been based on the JP '830 patent in view of the JP '949 patent and further in view of Harashina.

(1) The JP '830 Patent

The JP '830 patent discloses a polyacetal resin constituent containing polyacetal resin and a flame retarder, wherein the flame retarder consists of a phosphorous-containing compound and an aromatic compound which collaborates with the phosphorous-containing compound which promotes flameproofing" (claim 1).³

Regarding the polyacetal resin, the JP '830 patent mentions "a high molecular compound which makes an oxy-methylene group a main configuration unit, and the polyacetal copolymers ... containing a polyacetal homopolymer or polyoxymethylene. oxy-methylene units ..., and a comonomer unit are contained" (paragraph number [0013]).

The JP '830 patent also discloses that the flame retardants may be phosphorous-containing compounds such as organic phosphorous compounds and an inorganic phosphorus compound (paragraph number [0017]), and mentions that "Especially if an ... aromatic compound is a compound which collaborates with the [phosphorous-containing] compound, and can promote or improve flame proofing, it will not be restricted, but it promotes carbonization of polyacetal system resin with combination with the [phosphorous-containing] compound, and carries out flameproofing of the resin. ... A typical aromatic compound is the compound (for example, aromatic compound which was chosen from phenol nature hydroxyl and the amino group and which has a kind at least) which has a reactant hydrocarbon ring to formaldehyde" (paragraph numbers [0048] – [0050]).

Further, with regard to an additive, the JP '830 patent mentions "the resin constituent of ... this invention was chosen from ... for example, dripping inhibitor, antioxidants, and bulking agents according to the application" (paragraph number [0170]), "The flame-retardant-resin constituent of... this invention may contain ... a halogen content flame retarder, a sulfur content flame retarder, a silicon content flame

³ Applicants note that the phrase "Lynn content compound" should be interpreted as "phosphorus-containing compound".

retarder, an alcoholic system flame retarder, inorganic flame retardants (a metallic oxide, a metal hydroxide, metal carbonate, etc.)" (paragraph number [01841], and "Furthermore, to a resin constituent, a coloring agent ... a stabilizer [a thermostabilizer, a weathering (light) stabilizer...] ... maybe added" (paragraph number [0194]). The Examples of the JP '830 patent disclose that a hindered phenol-series antioxidant was used, and that the heat stabilizers included a zeolite, a hydrotalcite, and a compound an alkali or alkaline earth metal were used ([Example]).

The JP '830 patent mentions that, "... since a flame retarder is constituted combining the [phosphorous-containing] compound and a specific aromatic compound, high fire retardancy can be given to polyacetal resin. Moreover, flameproofing of the polyacetal resin can be carried out to altitude in little addition, without spoiling the property of resin original" ([Effect of the Invention]).

(2) The JP '949 Patent

The JP '949 patent discloses "A polyacetal composition for molding which contains at least 90 wt% of a polyacetal resin, and the residue is a melt mixture for improving characteristics comprising the resin and the following components (a) to (f): (a) an antioxidant such as a hindered phenol; (b) a metal salt of a hydroxycarboxylic acid ...; (c) a lubricant comprising one or more kinds of an alkylene distearyl amide, a long-chain amide, a wax, an oil, and an polyether glycid; (d) a nitrogen-containing heat stabilizer selected from the group consisting of an amidine compound, and a terpolymer obtained from caprolactam, hexamethylenediamine adipate and hexamethylenediamine sebacate; (e) a nucleus-forming agent selected from the group consisting of calcium hydrogencarbonate, a polytetrafluoroethylene fine particle, a talc, and a terpolymer obtained from trioxane, ethylene oxide and butanediol diglycidylether; and (f) an antistatic agent such as a polyethylene glycol, a fatty acid ester of an alkylene glycol, a polypropylene glycol, a polyethylene-polypropylene copolymer glycol, diethanolamide of lauric acid, diethanol laurylamine, or a mixture thereof" (Claim 1).

The polyacetal resin which is disclosed in the JP '949 patent is said to include "... an oxymethylene homopolymer ... preferably...an oxymethylene copolymer" (the lower left column of page 4, lines 9-17). Moreover, the JP '949 patent describes the antioxidant as "... a hindered phenol, which includes a bisphenol compound" (the upper right column of page 6, lines 7-13), and that the "... composition of the present invention contains the hindered phenol as an antioxidant in a proportion of about 0.1 to 2% by weight" (the lower right column of page 6, lines 12-15).

With regard to advantages of the JP '949 patent, it is described that it has "...superior resistance to yellowing during heat aging [and] exhibit excellent mechanical properties and processability in terms of lubricity, flowability, low mold deposit. Moreover, articles formed from the inventive compositions are highly stable against ultraviolet (U.V.) radiation." (the lower left column of page 8, lines 12-16 [Effects of the invention]).

(3) US 6,753,363 to Harashina

Harashina discloses "A polyacetal resin composition comprising a polyacetal resin, a flame retardant, and a basic nitrogen-containing compound, wherein the flame retardant comprises a phosphorus-containing compound and an aromatic compound which accelerates flame retardation in association with the phosphorus-containing compound, wherein the proportion of the phosphorus-containing compound is 1 to 500 parts by weight per 100 parts by weight of the aromatic compound, and the total amount of the phosphorus-containing compound and the aromatic compound is 1 to 100 parts by weight, and wherein the proportion of the nitrogen-containing compound is 0.01 to 80 parts by weight per 100 parts by weight of the polyacetal resin" (claim 1).

Harashina notes that the polyacetal resin is one which "...includes polyacetal homopolymers or polyoxymethylene and polyacetal copolymers" (column 3, lines 14-22).

Moreover, in regard to flame retardants, Harashina describes that they may be a "...phosphorus-containing compound [such as] organophosphorus compounds ... and inorganic phosphorus compounds." (column 4, lines 8-11). Harashina notes that there is "...no particular restriction as to the aromatic compound provided that it accelerates or improves the flame-retardation in association with the phosphorus-containing compound. By being used in combination with the phosphorus-containing compound, it accelerates the carbonization of a polyacetal resin and renders it flame-retardant. ... Typical aromatic compounds are ... compounds having a hydrocarbon ring reactive to formaldehyde (e.g., aromatic compounds having at least one group selected from phenolic hydroxyl group and amino group) and derivatives thereof." (column 9 line 43 to column 10, line 9).

Harashina discloses that the basic nitrogen-containing compound may include "...low-molecular weight compounds and macromolecular compounds (nitrogen-containing resin). The nitrogen-containing low-molecular weight compound may be ... aliphatic amines. an alicyclic amine ... an aromatic alkylamine an amino acid, or a derivative of any of these." (column 26, lines 29-59).

The resin compositions of Harashina are said to contain "... at least one member selected from a variety of additives such as drip inhibitors, antioxidants, heat stabilizers, and fillers" (column 31, lines 51-56), and the that "...flame retardant resin composition may comprise halogen-containing flame retardants, sulfur-containing flame retardants, silicon-containing flame retardants, alcohol-based flame-retardants, inorganic flame retardants [e.g., metal oxides, metal hydroxides, metal carbonates, zeolite ...] ... (column 34 lines 27-38). Moreover, there may be added "to the resin composition ... a colorant a weather (light) resistant stabilizer, a heat stabilizer, a mold releasing agent, a nucleation agent, an antistatic agent, a surfactant, an electroconducting agent, a slip agent [e.g., silicone oil, silicone resin, fluororesin, polyolefinic resin, poly(C₂₋₄ alkylene glycols)], a fluorescent whitening agent, an inhibitor for inhibiting a phosphoric acid derivative from being formed from a phosphine ..., impact resistance improvers ..." (column 35, lines 37-54). In the Examples of Harashina, a hindered phenol-series

compound as the antioxidant, a hindered amine-series compound, zeolite, hydrotalcite, and alkali or alkaline earth metal-containing compound as the heat stabilizer are used (columns 41-42).

Harashina the therein disclosed resin compositions as being "... high in stability as well as flame retardancy or self-extinguishability and capable of preventing dripping or glowing effectively and of inhibiting the generation of formaldehyde upon oxidation or thermolysis of a polyacetal resin." (column 37, lines 6-10). Moreover, Harashina mention that "...it is made possible to give high flame retardancy and stability to a polyacetal resin, It is also possible to make, without adversely affecting its inherent characteristics, a polyacetal resin highly flame retardant and stabilized by adding a small amount of the flame retardant. The heat stability (or fusion stability upon molding) can be further improved by adding additives" (column 37, line 63 to column 38, line 6).

4. Patentability Over Applied References

Applicants note that neither the JP '830 patent, the JP '949 patent nor Harashina disclose or suggest a polyacetal resin composition which is ***substantially free from a phosphorus-containing flame retardant***. Furthermore, such applied references do not disclose or suggest at all a combination of a polyacetal resin, and a ***specific*** phenol component and/or a ***specific*** amino acid in a ***specific*** ratio for a polyacetal resin composition as claimed herein.

In addition, the JP '830 patent, the JP '949 patent nor Harashina are all silent on using a ***specific*** antioxidant, a ***specific*** heat stabilizer, and a ***specific*** processing stabilizer in a ***specific*** ratio for a polyacetal resin composition as claimed herein. In particular, use of the specific processing stabilizer in the specific ratio is not disclosed in any of the applied references. Accordingly, applicants agree with the Examiner that the subject matter of the amended claims is novel in the light of the applied references.

However, applicants suggest that the amended claims herein are also unobvious over the combination of the applied references. In this regard, applicants suggest that

the presently claimed invention could not have been predicted from the applied references, because each of the JP '830 patent and Harashina disclose the critical **necessity** of employing a phosphorus-containing compound as an essential component therein and since the JP '949 patent is completely silent regarding the use of a specific phenol component and/or a specific amino acid as claimed herein.

The Examiner asserts that "it would have been obvious to the ordinary practitioner in this art to incorporate any of the additives of the [JP '949 patent] ... in the polyacetal compositions of [the JP '830 patent] to achieve their usual heat-stabilizing properties. It also would have been obvious to employ the amino acid of Harashina et al as a specific type of nitrogen component The nitrogen component is said to provide improved stability to the resin compositions".

However, even when the compositions of the JP '830 patent, the JP '949 patent and Harashina are combined, no prediction can be made for a composition having no phosphorus-containing compound and comprising relatively small amounts of a phenol component and/or an amino acid. In addition, although the JP '830 patent and Harashina relate to a polyacetal resin composition which exhibits improved flame retardancy, the JP '949 patent relates to a polyacetal resin composition having improved yellowing resistance. That is, the references are quite different in purpose and effect so the ordinarily skilled person would not consider combining them in the manner proposed by the Examiner. Accordingly, since the technical emphasis of the JP '830 patent and Harashina are quite different from that of the JP '949 patent, even though the compositions of the former may generally be related to polyacetal resin compositions, the combination of the JP '830 patent and Harashina with the JP '949 patent would not readily be accomplished by those skilled in the art.

In any event, the presently claimed invention provides unexpected advantages which could not be predicted from the combination of references applied by the Examiner to reject the previously pending claims. That is, the polyacetal resin compositions of the JP '830 patent, the JP '949 patent and Harashina cannot inhibit high

level formaldehyde emissions while improving processability or molding workability. In particular, in the applied references, since the polyacetal resin composition contains a large amount of an aromatic compound and a phosphorus-containing compound, so-called additive "bleed out" would occur even though the compositions exhibit improved flame retardancy.

The Examiner has also asserted that it would have been obvious to omit the phosphorus flame retardant component if flame retardant properties were not desired in the resulting compositions, since omission of a component along with its concurrent function is not invention. However, the effects achieved by the present invention could not be predicted by simply omitting any phosphorus-containing compounds from the compositions of the cited references. That is, even though the phosphorus flame retardant component may in fact be omitted from the compositions of the references so as to inhibit additive bleed-out, the manner in which formaldehyde emission may be inhibited could not be ascertained or predicted by an ordinarily skilled person with knowledge of the applied references.

On the other hand, since the compositions of the present invention comprise a polyacetal resin, and an extremely small amount of a specific phenol component and/or that of a specific amino acid (and further comprises a specific antioxidant, a specific heat stabilizer, and a specific processing stabilizer in a specific proportion), the compositions can nonetheless inhibit formaldehyde emission at a high level while sufficiently improving heat stability, particularly molding workability. For example, according to the present invention, as apparent from a comparison of Examples 9, 12 and 13 with Comparative Example 1 and comparison of Examples 1 and 5 with Comparative Example 1, the addition of the amino acid and/or the phenol component in a specific proportion ensures significant decrease of formaldehyde emission while maintaining properties such as the compositions' blooming property. Additionally, in Comparative Example 3 which comprises a large amount of the phenol component C not only is a considerable amount of formaldehyde emitted, but also a larger amount of mold deposit and deterioration of blooming property occurs. Thus, since the amount of

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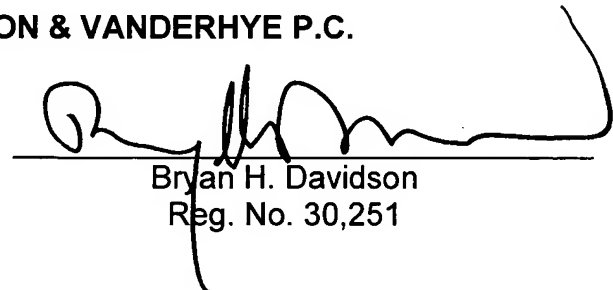
the phenol component employed in Comparative Example 3, although **large** in comparison to the compositions of the present invention, is much **smaller** in comparison to the amounts of phenol component that are disclosed in the JP '830 patent, the JP '949 patent and Harashina. As such, even with actual knowledge of the JP '830 patent, the JP '949 patent and Harashina, an ordinarily skilled person could not predict that substantially reduced formaldehyde emissions would or could result by using the specific components in the specific amounts as claimed herein.

In view of the above amendments and remarks, therefore, applicants suggest that all claims pending herein are in condition for allowance and early receipt of the Official Notice thereof is solicited.

Respectfully submitted,

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